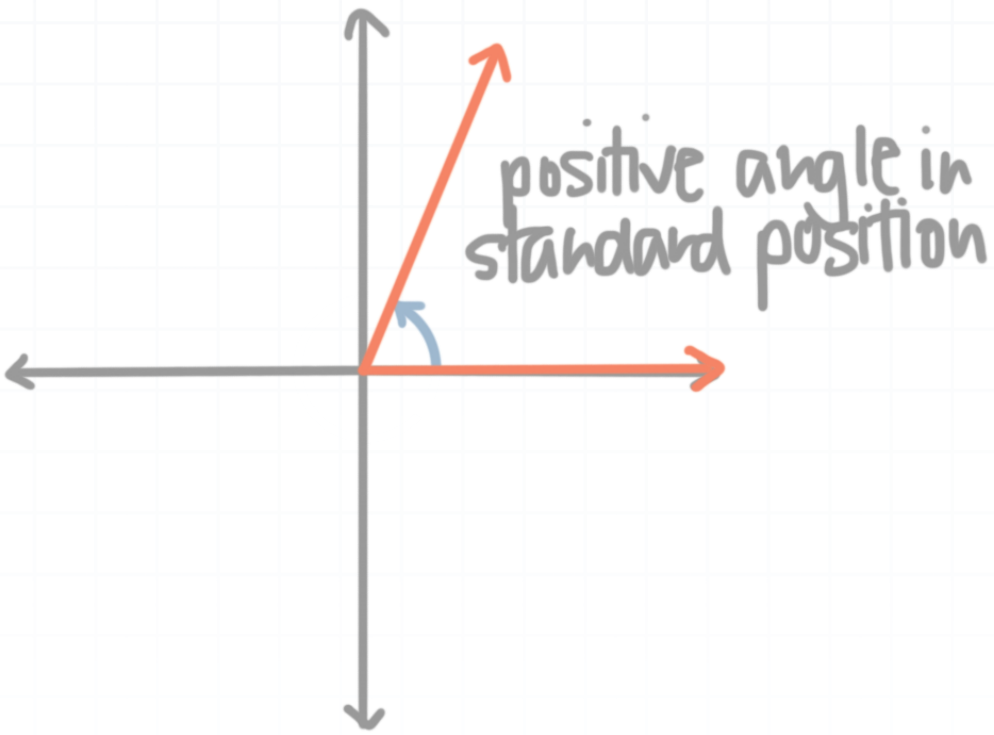
Sketching angles in standard position

When we sketch an angle in standard position, it means that we put one side of the angle on the positive side of the x-axis, and have the angle open up into the first quadrant, toward the positive direction of the y-axis.



In standard position, we get positive angles by starting along the positive side of the x-axis and rotating counterclockwise toward the positive direction of the y-axis. If we have a negative angle and want to sketch it in standard position, we start along the positive direction of the x-axis, but rotate clockwise toward the negative direction of the y-axis.

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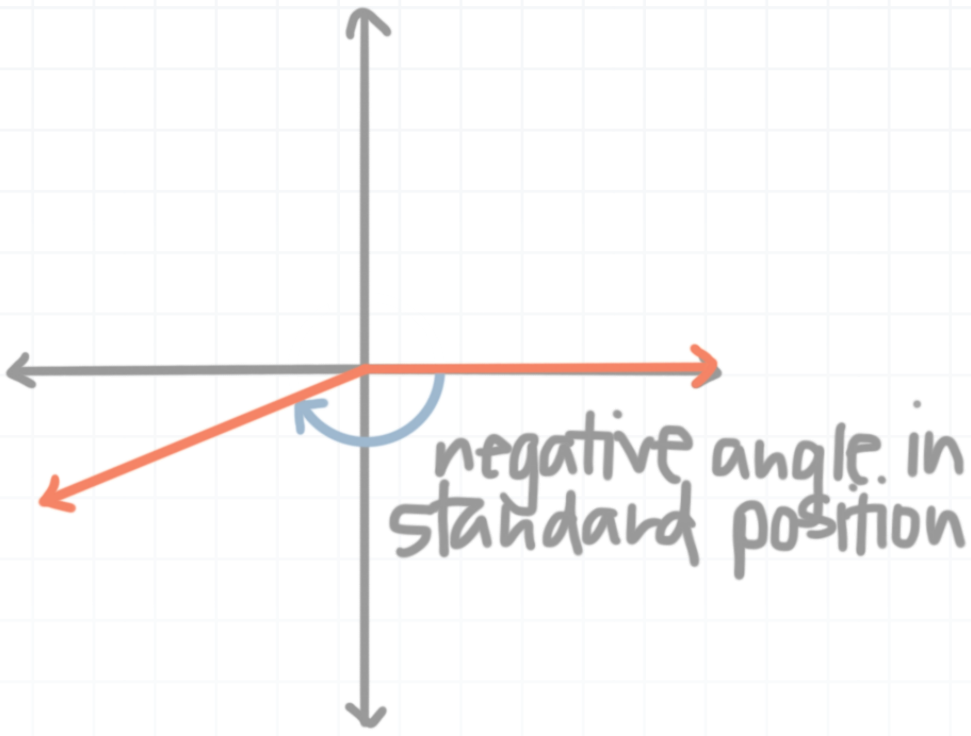

Example

Sketch a 110° angle in standard position.

Since the angle is larger than 90° but smaller than 180°, it's obtuse. We put one side along the positive direction of the x-axis, and since the angle is positive, open up counterclockwise past the y-axis until we get to 110°.

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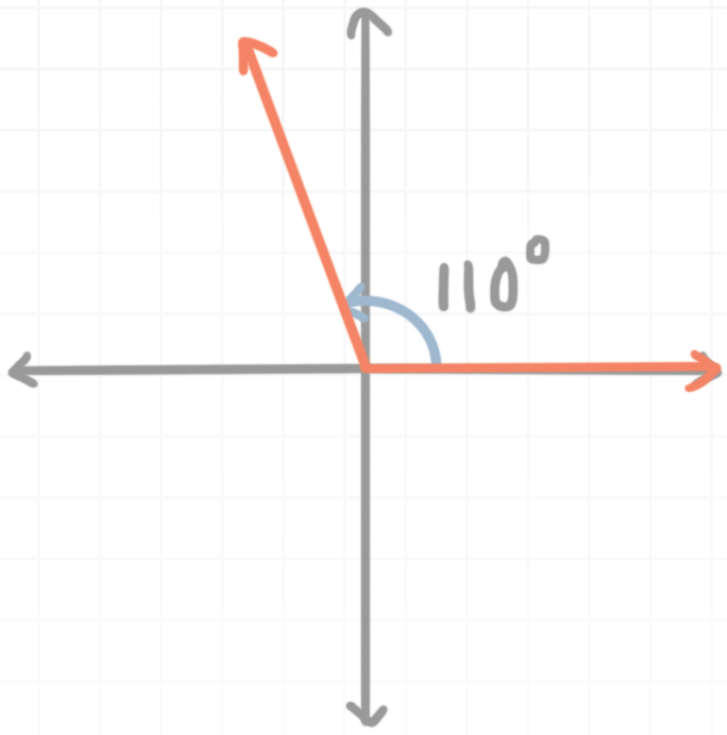

Let’s do an example with a negative angle in radians.

Example

Sketch $-\pi/3$ radians in standard position.

Since $\pi/3$ is less than $\pi/2$, it’s an acute angle. We’ll put one side along the positive direction of the x-axis, and since the angle is negative, open up clockwise until we get to $-\pi/3$.

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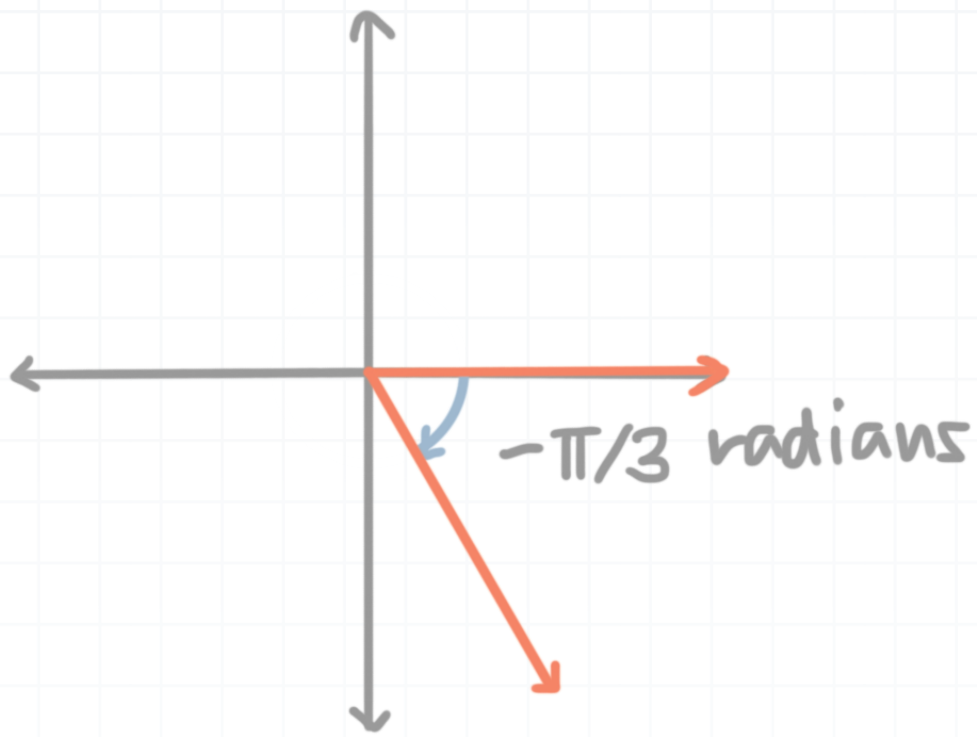

Up to now we've been talking about angles that are less than one full rotation around a circle. A full circle is $360°$ or 2π radians, and the angles we handle most of the time are smaller than a full rotation.

But we can also have angles that are greater than a full rotation. For example, the angle $600°$ is more than a full rotation, because $600° > 360°$. Because $600° - 360° = 240°$, the angle $600°$ just means that we're rotating a full $360°$, but then continuing on another $240°$ more.

Example

Sketch $420°$ in standard position.

Since $360° < 420°$, the angle $420°$ is more than one full rotation. We'll find out how much more by finding the difference between the angles.

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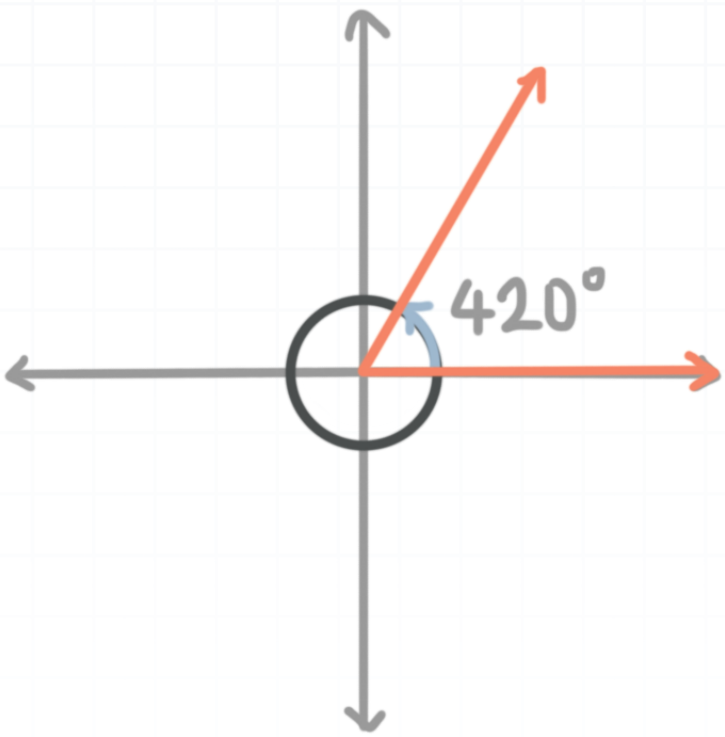
$$420^\circ - 360^\circ = 60^\circ$$

Therefore, to sketch the angle, we'll rotate one full rotation but then an additional 60°. The angle will look like a normal 60°, but in the figure, the gray arc shows the first 360°, and the blue arc shows the extra 60° of the rotation.



Sometimes we'll need to sketch angles in radians that aren't in terms of π. Let's do an example where we look at how to figure out what that angle looks like.

Example

Sketch 4.0 radians in standard position.

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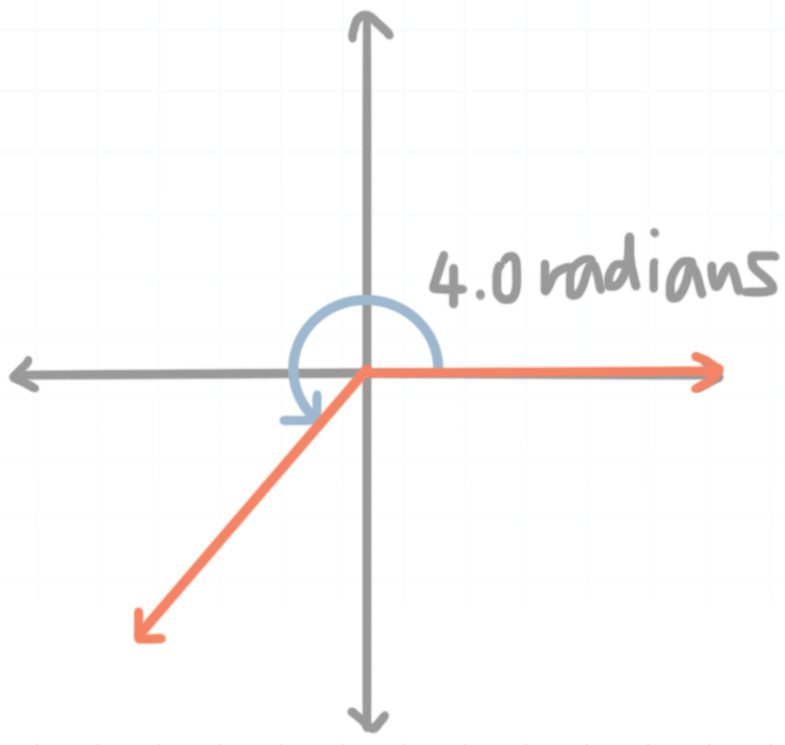
First, we'll want to divide 4.0 by π, which gives us about 1.27, so $4.0 \approx 1.27\pi$. This is between 1π and 1.5π, which means the angle will lie somewhere in the third quadrant.

Since we'll be 0.27π past π or $180°$, we can say that we're about $0.27(180°) = 48.6°$ past π. That's a little over half of the way from π (along the negative direction of the x-axis) to $3\pi/2$ (along the negative direction of the y-axis). So the angle looks about like this:



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